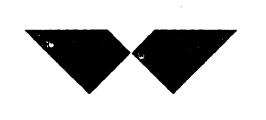
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SEDIMENT AND SHORE SAMPLE COLLECTION WAUKEGAN HARBOR SLIP #3
WAUKEGAN, ILLINOIS
C 9729



Consulting Engineers • Civil • Structural • Geotechnical • Materials Testing • Soil Borings • Surveying

1409 EMIL STREET, P.O. BOX 9538, MADISON, WIS. 53716 • TEL. (608) 257-4848

May 26, 1981 C 9729

3

Mason & Hangar - Silas Mason Co. Inc. 1500 West Main Street Lexington, KY 40505

Attention: Marion Lail

Re: Waukegan Harbor Slip No. 3 Investigation

Waukegan, Illinois

#### Gentlemen:

We have completed the soil sampling and testing at Waukegan Harbor Slip No. 3 and hereby submit six (6) copies of the subject report for your use. The investigation was performed in accordance with our subcontract agreement for the above referenced project.

We hope that the report is suitable for your needs. If you have any questions with regard to the report or additional work to be performed, please do not hesitate to contact us.

Very truly yours,

WARZYN ENGINEERING INC.

Daniel R. Viste, CPGS

Project Manager

DRV/dkp [WEI-33-12]

Encl: As Stated

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- Appendix D Soil Test Results
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# SEDIMENT AND SHORE SAMPLE COLLECTION WAUKEGAN HARBOR SLIP #3 WAUKEGAN, ILLINOIS

#### INTRODUCTION

This report describes soil sampling and testing performed during March 16-through March 25, 1981 at the Waukegan Harbor Slip #3. Waukegan Harbor is located in Section 22, T45N, R12E, Lake County, Illinois. Slip #3 is located at the north end of the Harbor (see Drawing C 9729-B1). The purpose of the sampling program was to obtain soil samples at specified depths for polychlorinated biphenyl (PCB) analysis and to test particular engineering properties of the organic clayey silt (muck). Chain of custody methods were employed and care was taken to attempt collection of chemically undisturbed samples as requested by Mason and Hanger - Silas Mason Company, Inc., (MHSM). The methods used are described later in the text.

#### CHAIN OF CUSTODY PROCEDURES

Chain of custody procedures were employed with regard to handling of sediment core samples obtained in the investigation. The following discussion describes chain of custody procedures employed.

During March 17 through March 20, 1981, seventeen sediment core samples (ASTM D1586) from Borings B7, B8 and B9 were obtained; and during March 23 and March 24, 1981, seventeen additional sediment core samples from Borings B10, B11, and B12 were obtained. These samples required chain of custody procedures. Each sample was placed in a 32 oz. jar, and each jar boxed. At the end of each work shift and during the lunch break, the samples were stored under observation or were locked securely. When a box was filled, it was affixed with a U.S. Environmental Protection Agency



(U.S.E.P.A.) approved chain of custody seal and stored under secure lock. At the end of the work week on March 20, 1981, and again on March 25, 1981, each partially filled box was affixed with a U.S.E.P.A. approved chain of custody seal. Boxes #1 and #2 were transferred by the field sampler, Geoffrey F. Prior, of Warzyn Engineering Inc., and delivered to Vincent Deneen of Raltech Scientific Services of Madison on March 20, 1981. Boxes #3 and #4 were likewise delivered to Raltech on March 25, 1981. On April 1, 1981, two additional sediment core samples (B10S3A and B12S4A) were likewise delivered to Raltech. Warzyn Engineering retained custody of three sediment core samples. These are: B9S2, B11S3, and B12S3. Each of these was affixed with a U.S.E.P.A. approved chain of custody seal and stored under secure lock at Warzyn Engineering Inc.

A summary of sediment core samples obtained and parties accepting final responsibility is as follows:



		PERSON/COMPANY
BORING LOCATION	SAMPLES OBTAINED	ASSUMING CUSTODY
В7	B7S1	Vincent Deneen/Raltech
U,	B7S2A	II
	B7S2B	ti .
	B7S3	n
	B7 S4	п
	B7S5	· H
B8	B8S1	п
ВО	B852A	u .
	B8S2B	ш
	B8S3	и
	B8S4	u
B9	B9S2	Geoffrey F. Prior/Warzyn
9	B953	Vincent Deneen/ Raltech
	B9S4A	וו
	B9S4B	u
	B9S5	н
	B9S6	
P10	B10S1	u
B10	B10S2	n .
	B1052	ii.
	10S3B	H
	B10S4	II.
D 1 1	B11S1	н
B11	B1152	н
	B1153	Geoffrey F. Prior/Warzyn
	B1154	Vincent Deneen/Raltech
	B1134 B11S5	"
	B1133	и
0.10	B1130 B12S1	н
B12		и
	B12S2	Cooffnoy E Prior Marzyn
	B12S3	Geoffrey F. Prior/Warzyn
	B12S4A	Vincent Deneen/Raltech
•	B12S4B	n
	B12S5	<del>.</del>

-3-



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#### SAMPLE COLLECTION AND FIELD PROCEDURES

Prior to loading onto the barge, the drill rig (CME 550) and related drilling equipment were steam cleaned at Falcon Marine Waukegan, Illinois to remove oil, grease, and mud. Harbor drilling operations were accomplished by positioning the drill rig on two joined section barges (total dimensions approximately 20 feet by 40 feet) which were initially powered to Slip #3 by a tugboat and later manually moved to boring locations. Drilling operations were performed off the end of the barge.

Present during drilling operations were Warzyn Engineering drillers and a field geologist. Jeffery L. Bruestle, of ENCOTEC, observed from the near shore.

The following general procedures were employed at each boring location. The boring location was determined from the drawing enclosed with Attachment I of the Scope of Work from MHSM. The appropriate dimensions were measured using a fiberglass tape. Actual boring locations were adjusted from the plan locations somewhat to accommodate field conditions. All boring locations are within 10 feet of the plan locations. The barge was maneuvered into position manually and secured with ropes and chains. Water depth was measured using a 30 inch diameter piece of sheet metal which was lowered to the top of the muck. A weighted fiberglass tape was then lowered to the sheet metal and the water depth read. The water depth was referenced daily to the Falcon Marine Red Marker (Elevation 583.37 feet). For the land borings near Slip #3, the same general procedures were employed without the barge. Land boring elevations were obtained using a conventional surveying instrument and were referenced to an assumed elevation of 100.00 feet on the top nut of a fire hydrant located approximately 170 feet northwest then 150 feet southwest of the north corner of Slip #3. See Drawing C 9729-B1 for boring locations. WARZYN Muck samples were obtained at Borings B7, B8 and B9. A clamshell sampler was employed, and an effort was made to obtain representative samples of the top, middle, and bottom of the muck unit. The muck samples were placed in separate five-gallon plastic buckets with water tight lids and delivered to Warzyn Engineering for physical tests. The muck was sampled at the location of Borings B7 and B8, and in the vicinity of Boring B9. At boring location B9, the muck unit was overlain by recently deposited sand and gravel, thereby precluding muck sampling at this location. Apparently, the propeller action of the tug and other boats disturbs the sediments. Drilling at Boring B9 revealed 9.1 feet of sand and gravel stratified with muck.

Drilling tools and related apparatus were cleaned with acetone and placed on clean polyethylene plastic sheeting. A 4-inch diameter casing was then lowered into the water and allowed to settle under its own weight into the muck. Based on past practices, a measurement of the amount of settlement of the casing equals the thickness of the muck.

The sediment inside the casing was then flushed out with harbor water using conventional rotary drilling procedures. At boring locations B8 and B9, the wash water and drill cuttings were allowed to pass back into the harbor at the boring location while the water intake for the pump was kept at the opposite side of the barge in order to minimize contamination with recirculated water. At boring locations B7, B10, B11 and B12, the wash water and drill cuttings were retained in the wash tub. Recirculated water was not used. When the wash tub became full of water, it was decanted into the harbor and the drill cuttings retained for later hazardous waste disposal.



A sediment sample was then obtained by driving a 2-inch diameter, acetone rinsed, split-barrel sampler for 18 or 24 inches using a 140 pound weight falling freely through a distance of 30 inches (ASTM D1586). The split-barrel samples were opened onto clean polyethylene plastic sheeting and visually examined. The sediment sample was scrutinized for length of recovery, zones of oily sediment, and field identification. The recovered sample was then: 1) Cut into a six-inch section, 2) Placed in an acetone rinsed 32 oz. jar, 3) Capped with aluminum foil and a screw-on lid, 4) Assigned a boring and sample number (when more than one sample was obtained from one split-barrel, letter designations were assigned. An 'A' designation indicates a sample from the lower portion of the split-barrel. A 'B' designation indicates a samples from above the 'A' portion), depth of sample, blow counts, date, and time; and 5) Placed into a box which was affixed with a USEPA approved chain of custody label.

The borings were advanced by either drilling the casing downward, or by driving the casing with a 350 pound weight to the desired sample depth, and then flushing out the casing as previously mentioned. Sampling intervals were designated by Mason and Hanger - Silas Mason Co. Inc., and were adhered to as closely as possible. In a few cases, field conditions would not permit a sample at the designated depth, in which case the sample was obtained as close to the designated depth as practically possible.

At the end of each borehole sampling, approximately twenty pounds of bentonite pellets were used to plug the hole. The casing was then pulled. Any drill cuttings remaining in the wash tub were then shoveled into 55 gallon drums for disposal as hazardous waste. The tools, washtub, deck of the barge and rear of the drill rig were hosed down with harbor



water between boreholes to remove sediment and to flush the pump and hoses. The tools, casing, and drill rods were rinsed with acetone and placed on clean polyethylene sheeting in preparation for the next boring.

Logs of borings were kept throughout the sampling operation. Sediment descriptions are based on previous laboratory testing and the experience of the field geologist. Warzyn Engineering performed no laboratory testing on the underlying sand and clay sediments. Refer to Appendix C for boring logs.

#### ENGINEERING TEST RESULTS AND GENERAL SEDIMENT STRATIGRAPHY

The scope of work did not include testing of sand and clay sediments by Warzyn Engineering. Three muck samples were tested by Warzyn Engineering for density, gradation (ASTM D 117-80), hydrometer (ASTM D 422-80), and percent moisture (ASTM D 2216-80). These test results are summarized in Appendix D. The muck thickness varies from 1.8 feet at B7 to 2.9 feet at B8, with a thickness of stratified, recently deposited sand, gravel and muck measuring 9.1 feet at B9.

For the land borings, thicknesses of fill varied from 0.5 feet to approximately 7.5 feet. The fill is typically a gravel roadbed underlain by a crushed stone fill. An old buried wood seawall was encountered at plan boring location B10 necessitating relocation of this boring. The wood seawall trends approximately parallel to and approximately 10 feet northwest of the present sheet piling seawall.

Beneath the muck or fill unit is predominately a gray, fine to medium sand (SP-SM), little to trace silt, little to trace fine to coarse gravel. The upper portion of the sand unit contained thin lenses of black,



organic silt (OL) and wood (Pt) at Boring B12. The lower portion of the sand unit contained thin lenses (1" to 2") of coarse sand and fine gravel. At the bottom of the sand unit, a layer approximately 1" to 2" thick of very oily, coarse, sandy, fine to medium gravel was typically encountered. The thickness of the sand unit varied from 3.1 feet at Boring B9 to 13.7 feet at Boring B11.

- j -

Underlying the sand unit is a gray silty clay, little fine to coarse sand, little to trace fine to coarse gravel (CL). Each boring penetrated five feet into this unit. A lense of very dense, gray silt (ML) was encountered within this unit at Boring B7. An oily appearance was typically not encountered in the clay unit except for the top one foot at Boring B7.

#### CLOSING REMARKS

We trust this report, and the information contained herein, meets your present needs. If you have any questions or desire further information, please contact us.

Respectfully submitted,

WARZYN ENGINEERING INC.

Geoffrey F. Prior

Geologist

and Wite pa

Daniel R. Viste, CPGS Project Manager

GFP/DRV/cgj/dkp [WEI-7-2]



#### APPENDIX "A"

#### Subsurface Investigation

#### GENERAL REMARKS

We have endeavored to evaluate subsurface conditions and physical properties of the subsoil as revealed by the borings and laboratory testing. A problem inherent in this evaluation is the variability in engineering properties within soil strata involved, and specifically in any location variation in the soil which is located between borings. Due to natural or man-made causes, subsurface conditions may change with time.

Conclusions drawn and recommendations given in this report are for a specific proposed use of this site. They are our opinions and are based upon conditions that existed at the boring locations and such parameters as proposed site usage, soil loading, elevations, etc.

Since subsurface conditions depend on seasonal moisture variations, frost action, construction methods, and the inherent natural variations, careful observations must be made during construction. These should be brought to our attention as it may be necessary to modify the conclusions and recommendations presented herein.

#### APPENDIX "B"

# FIELD METHODS for EXPLORATION AND SAMPLING SOILS

#### A. Boring Procedures Between Samples

The bore hole is extended downward, between samples, by a continuous flight auger, driven and washed-out casing, or rotary boring with drilling mud or water.

## B. Standard Penetration Test and Split-Barrel Sampling of Soils (ASTM\* Designation: D 1586)

This method consists of driving a 2" outside diameter split barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6" into the material to be sampled and then driven 12". The number of blows required to drive the sampler the final 12" is recorded on the log of borings and known as the Standard Penetration Resistance. Recovered samples are first classified as to texture by the driller. Later, in the laboratory the driller's classification is reviewed by a soils engineer who examines each sample.

#### C. Thin-walled Tube Sampling of Soils (ASTM\* Designation: D 1587)

This method consists of forcing a 2" or 3" outside diameter thin wall tube by hydraulic or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

# D. Soil Investigation and Sampling by Auger Borings (ASTM\* Designation: D 1452)

This method consists of augering a hole and removing representative soil samples from the auger flight or bucket at 5'0" intervals or with each change in the substrata. Relatively disturbed samples are obtained and its use is therefore limited to situations where it is satisfactory to determine approximate subsurface profile.

### E. Diamond Core Drilling for Site Investigation (ASTM\* Designation: D 2113)

This method consists of advancing a hole in hard strata by rotating downward a single tube or double tube core barrel equipped with a cutting bit. Diamond, tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. Normally a 2" 0.D. by 1 3/8" I.D. coring bit is used unless otherwise noted. The rock or hard material recovered within the core barrel is examined in the field and laboratory. Cores are stored in partitioned boxes and the length of recovered material is expressed as a percentage of the actual distance penetrated.

\*American Society for Testing and Materials, Philadelphia, Pennsylvania

#### APPENDIX C

LOG OF TEST BORING - GENERAL NOTES

UNIFIED SOIL CLASSIFICATION SYSTEM INFORMATION

LOGS OF TEST BORING NOS. B7 - B12



#### LOG OF TEST BORING



General Notes

#### **Descriptive Soil Classification**

#### **GRAIN SIZE TERMINOLOGY**

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	. Larger than 12"	. Larger than 12"
Cobbles	. 3" to 12"	. 3" to 12"
Gravel: Coarse	. 34 ° to 3 °	. 3 a 10 3"
Fine	. 4.76 mm to 3/4"	=4 to 34"
Sand: Coarse	, 2 00 mm to 4.76 mm	. #10 to #4
Medium	. 0 42 mm to 2.00 mm	=40 to =10
Fine	. 0 074 mm to 0 42 mm	. =200 to =40
Silt	. 0 005 mm to 0.074 mm	Smaller than #200
Clay	. Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay

#### GENERAL TERMINOLOGY

#### RELATIVE DENSITY

Physical Characteristics	Term "N" Value
Color, moisture, grain shape, fineness, etc.	Very Loose 0-4
Major Constituents	Loose 4-10
Clay, silt, sand, gravel	Medium Dense 10-30
Structure	Dense 30-50
Laminated, varved, fibrous, stratified, cemented, fissured, etc.	Very Dense Over 50
Geologic Origin	

### RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Glacial, alfuvial, edian, residual, etc.

#### **CONSISTENCY**

OF CORES	NOWLESS SOILS	Term	qtons/sq. ft.				
Proportional Term	Defining Range By Percentage of Weight	• • •	0.0 to 0.25				
	0%- 5% 5%-12%	Medium	0.50 to 1.0				
		******	2.0 to 4.0				
And	35%-50%	Hard	Over 4.0				

### ORGANIC CONTENT BY COMBUSTION METHOD

#### **PLASTICITY**

Soil Description	Loss on Ignition	Term	Plastic Index
Non Organic	Less than 4%	None to Slight	0-4
Organic Silt/Clay	4-12%	Slight	5-7
Sedimentary Peat	12-50%	Medium	8-22
Fibrous and Woody Pear	t More than 50%	High to Very I	ligh Over 22

The penetration resistance, N, is the summation of the number of blows required to affect two successive 6" pentrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

#### **Symbols**

#### DRILLING AND SAMPLING

CS-Continuous Sampling

RC-Rock Coring: Size AW, BW, NW, 2" W

RQD-Rock Quality Designator

RB-Rock Bit

FT—Fish Tail

DC-Drove Casing

C-Casing: Size 21/2", NW, 4", HW

CW-Clear Water

DM-Drilling Mud

HSA-Hollow Stem Auger

FA-Flight Auger

HA-Hand Auger

COA-Clean-Out Auger

SS-2" Diameter Split-Barrel Sample

2ST-2 Diameter Thin-Walled Tube Sample

3ST-3" Diameter Thin-Walled Tube Sample

PT = 3" Diameter Piston Tube Sample

AS-Auger Sample

WS-Wash Sample

PTS - Peat Sample

PS-Pitcher Sample

NR-No Recovery

S-Saundina

PMT Borehole Pressuremeter Test

VS—Vane Shear Test

WPT-Water Pressure Test

#### LABORATORY TESTS

q.-Penetrometer Reading, tons/sq. ft.

 $q_u$ —Unconfined Strength, tons/sq. ft.

W-Maisture Content, %

LL-Liquid Limit, %

PL-Plastic Limit, %

SL—Shrinkage Limit, %

LI-Loss on Ignition, %

D-Ory Unit Weight, Ibs./cu. ft.

pH-Measure of Soil Alkalinity or Acidity

FS-Free Swell, %

### WATER LEVEL MEASUREMENT

 $\nabla$  — Water Level at time shown

NW-No Water Encountered

WD-While Drilling

BCR—Before Casing Removal
ACR—After Casing Removal

CW—Caved and Wet

CM-Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.



### **UNIFIED SOIL CLASSIFICATION SYSTEM**

#### **COARSE-GRAINED SOILS**

(More than half of material is larger than No. 200 seive size.)

#### GRAVELS

More than half of coarse fraction larger than No. 4 sieve size Clean Gravels (Little or no fines)

**GW** Well-graded gravels, gravel-sand mix tures, little or no fines

**GP** Poorly graded gravels, gravel-sand mixtures, little or no fines

Gravels with Fines (Appreciable amount of fines)

GM d Silty gravels, gravel-sand silt mixtures

GC Clayey gravels, gravel sand-clay mixtures

#### SANDS

More than half of coarse fraction smaller than No. 4 sieve size Clean Sands (Little or no fines)

SW Well-graded sands, gravelly sands, little or no tines

SP Poorly graded sands, gravelly sands, little or no fines

Sands with Fines (Appreciable amount of fines)

SM d Silty sands, sand-silt mixtures

SC Clayey sands, sand-clay mixtures

#### FINE-GRAINED SOILS

(More than half of material is smaller than No. 200 sieve.)

#### SILTS AND CLAYS

Cigaid limit - 1. (han - 50 % Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity

CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

OL Organic silts and organic silty clays of low plasticity

#### SILTS AND CLAYS

CLAYS
Lequid limit
greater than
50%

MH Inorganic silts, micaceous or diatoma ceous fine sandy or silty soils, elastic silts

CH Inorganic clays of high plasticity, fat clays

OH Organic clays of medium to high plasticity, organic silts

HIGHLY ORGANIC SOILS

PT Peat and other highly organic soils

#### LABORATORY CLASSIFICATION CRITERIA

**GW**  $C_u = \frac{D_{x_0}}{D_{x_0}}$  greater than 4,  $C_c = \frac{(D_{x_0})^2}{D_{x_0} X D_{x_0}}$  between 1 and 3

GP Not meeting all gradation requirements for GW

GM Atterberg limits below A fine or PT less than 4

Above A line with P1 between 4 and 7 are borderline cases requiring use of dual symbols

GC Atterberg timits above A time with P I greater than 7

greater than 6,  $C_c = \frac{(D_{10})^2}{D_{10}XD_{20}}$  between 1 and 3

SP Not meeting all gradation requirements for SW

SM Atterberg limits below 'A line or PT less than 4

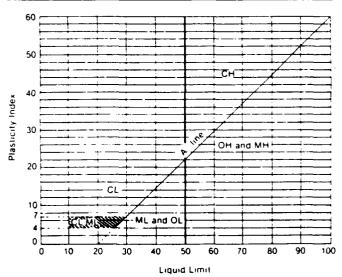
SW

Limits plotting in hatched zone with P1 between 4 and 7 are borderline cases requiring use of dual symbols

SC Alterberg limits above A line with PT greater than 7

Determine percentages of sand and gravel from grain-size curve Depending on percentage of lines (fraction smaller than No. 200 sieve size), coarse grained soils are classified as follows. Less than 5 per cent. GW GP SW SP GM GC SM SC 5 to 12 per cent. Borderline cases requiring dual symbols.

#### **PLASTICITY CHART**



For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched area are borderline classifications requiring use of dual symbols

Equation of A-line PI = 0.73 (LL - 20)



## LOG OF TEST BORING

Project Waukegan Harbor Slip #3 80'SE & 7.5'SW of North

Location Corner of Slip #3

Boring No. ... B7 579.12 Surface Elevation Job No. C 9729

.1....of

Sheet

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	s	AM	PL	E		VISUAL CLASSIFICATION	so	IL P	ROP	ERT	IES
		very	1 1			and Remarks		w	lL	PL	D
No.	Type	+	+	N	Depth		qu		-		
					-						
					5 -	WATER to 10.4'			<u> </u>		
					<u> </u>						
	<i>.</i>				<u> </u>	·			<u> </u>		
						Black MUCK (OL)					
						Dense, Gray, Fine to Medium					
					15-	SAND, Some Silt Trace Fine					
					E	to Coarse Gravel (SP-SM)					
1_	SS_	χ_	W	43		Very Oily at 18-18.5'					
_2_	SS	X	M	37	20	Very Stiff, Gray, Silty CLAY, Little Fine to Coarse				-	
3 4	SS SS	X	M	21 83	E	Sand, Trace Fine to Coarse					
5	SS	X	M	110	E	Gravel (CL) Oily to 19.5' Very Dense, Gray SILT, Little Fine Sand (ML) Not Oily	†				
					25-	Borehole Backfilled with Bentonite	<del> </del>				
					<u> </u>	End Boring at 24.5'					
	-					,					
					30 -			<del></del>			
					E						
	<del> </del>				35-						
					E	•					
											<del> </del>
					40 -						
	WATER LEVEL OBSERVATIONS							NER	AL	NOT	ES
	While Drilling							3/16/8			
-	Upon Completion of Drilling							v Chief ng Met 5'; Ro	U.K. F 4' hod	Cas	ing to
	pth to			-						Wash	Bore
De	pth t	o Ca	ve In	-			اها	ptit S	poon		)

#### LOG OF TEST BORING

OMC

Project Waukagan Harbor Slip #3

122'SE & 5'SW of North

Location Corner of Slip #3

Boring No. B8

Surface Elevation 578.92

Job No. C 9729 Sneet 1 of 1

\_\_\_\_1409 EMIL STREET • P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848\_\_\_\_

	S	AM	PLI	Е		VISUAL CLASSIFICATION	so	IL PF	ROP	ERT	IES
N.	<del></del>	very	Mois	ture N	Depth	and Remarks	gu	w	11	PL	D
NO.	Type										
					5	WATER to 10.9'					
					1	Very Loose, Black MUCK (OL)					
1	SS	χ	3	19	15- - - - - - - - - -	Medium Dense, Gray Fine to Coarse SAND, Little Silt, Little Fine to Coarse Gravel Slightly Oily (SW-SM)					
2	SS	X	W/M	39	<u> </u>		<b>†</b>				
3	SS	X	M	29		Very Stiff, Gray Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel Not Oily (CL)					
4	SS	Х	М	85	25 -	Not Oily at Bottom of Boring					
					30-	Borehole Backfilled with Bentonite End Boring at 27.5'					
					35-						
			W	/Δ٦	<u> </u>	LEVEL OBSERVATIONS	GF	NER	A 1 A	VOT	FS
Up Tin De	on C	ompl fter [ o Wa	J	of [	Drilling		Start Crew	3/19/8 Chief ng Meth 21.5';	IComp JR R	olete3/ ig CMI " Cas	/19/81 550

#### LOG OF TEST BORING

Project Waukegan Harbor Slip #3 105'SE & 59'SW of North

Location ....

Corner of Slip #3

Boring No.

Surface Elevation 578.92 Job No. C 9729

Sheet .... 1 .... of . . 1 .....

	S	AM	IPL	E		VISUAL CLASSIFICATION	SO	L PF	ROP	ERT	IES
	T7	very	Mois			and Remarks	Дu	w	LL	PL	D
10.	Type	. 🕈	*	N	Depth				ļ		
			<del></del>		<del>[</del>						
	l				F	WATER to 5.7'			ļ		
	ļ <del>-</del>					MATER 33 34.			ļ		
_					E 5						
<u>.</u>					F, -	*	<del>- </del>				
1	SS	_0	_	0		Very Loose, Gray & Black	7				
_					F	Fine to Medium SAND, Some					
					F.,	Silt, Some Organics (Stratified					
	1				10-	Muck & Sand) Not Oily (SP-SM/OL)					
					E	Split Spoon Settled from 6.1-9.1'	1 1				
2	SS	Х	W	1	-				]		
۲	33	Δ	l n		<u> </u>	Under Weight of Hammer-No Blows	<u> </u>				
			<del> </del> -	ļ. <u>.</u>	15	Loope Cook Fire to Madien	╼╂╼╼═┼				
					F	Loose, Gray Fine to Medium SAND, SomeSilt, Not Oily					
_	66		١	١,	-	(SM)					
3_	SS_	_X	W		E	· · ·					
4	SS_	X	M_	79	E 20	Very Stiff, Gray Silty CLAY,					
				i	-	Little Fine to Coarse Sand, Little Fine to Coarse Gravel					
_	00	v		00		Not Oily (CL)					
5	SS	Х	М	80	F	4" Lense of Fine to Coarse Sand					
6	SS	X	M	63	25	at 19.8-20.1'					
					E 23	Not Oily At Bottom of Boring Borehole Backfilled with Bentonite					
						End Boring at 24.5'					
						End boring at 24.5					
					F			,			
			<u> </u>		30					- 1	
					El	* Black, Fine to Coarse SAND,					
					<u> </u>	Little Fine to Coarse Gravel,					
	1				<b>F</b>	Little Silt (SW-SM)					
			<del> </del>		35-	•	<b> </b>				
					F		]				
					El						
	· <del> </del>			<del>                                     </del>	<u>†                                    </u>					1	
	<del> </del>				<del>-</del> 40 −		<b>  </b>				
WATER LEVEL OBSERVATIONS						GE	NER	AL I	NOT	ES	
Wł	nile D	rillind	3		•		Start	3/18/8	Com	plete3	/18/
While Drilling Upon Completion of Drilling							Crew	Chief	JR R	Ria CME	550
Time After Drilling							Drillin	ng Met	hod 4	4" Ca	sing
	pth to			<i>3</i> -			to	20.5';	Rota	ary W	asn
	•		ve In	-			Bor	e & Si	lit :	Spoon	

# LOG OF TEST BORING

Waukegan Harbor Slip #3 35'SE & 7.5'NE of North

Corner of Slip #3 Location ....

Boring No. . . . B10 Surface Elevation 95.68 Job No. C 9729 Sheet 1 of

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	S	AM	PLI	E		VISUAL CLASSIFICATION	so	IL PF	ROP	ERT	IES
		_ ,* 1	Mois		Do-AL	and Remarks	Qu	w	LL	PŁ	D
No.	Type	+	*	- N	Depth	<del></del>	-				
	- SS		W	16	<u> </u>	*	1	<b> </b>			
	33			10	_	Coarse GRAVEL, Some Sand, Little					
						Silt (FILL-Crushed Stone) Not Oily (GP-GM)	<u></u>				
						51 <sub>1</sub> , <b>5</b> (3. 3.1)					
	-										
						Very Loose, Gray, Fine to Medium		-			
			-		ר"	SANĎ, Little Silt, Little Fine					
2		v		2		to Coarse Gravel, Not Oily, Lense of Coarse Sand & Fine					
2_	SS_	Χ	W	_2		Gravel at 12.8' to 13.0' (SP-SM)					
					15-						
					E	Wash Water Turned Oily at 19.5'					<del></del>
3	SS	X	W/M	37	20	· · · · · · · · · · · · · · · · · · ·					
					E	Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand,					
						Little Fine to Coarse Gravel, Not Oily (CL)					
4	SS	<u>X</u>	M	63	25 –	Not Oily (CL) Not Oily at Bottom of Boring					
						Borehole Backfilled with Bentonite	1				
	ļ			<u>-</u>		End Boring at 25.9'					
					30-						
		,									
					E						
					<u> </u>	<ul><li>* Brown Fine to Coarse Sandy GRAVEL, Some Silt (Roadbed)</li></ul>					
						(SW-SM)					
					E i						:
					_ 40 ~						
			١٨	′ΔΤ	<u> </u>	LEVEL OBSERVATIONS	GE	NER	<u> </u>	JOT	ES
144		.:					<del> </del>	3/24/8			
While Drilling								Chief			
					Drillin	ng Meth	nod .		· · · · ·		
	pth to			_		to   Bor	21.5'; e & Sp	Rota lit S	ry W	ash	
De	pth to	Ca	ve In	_			1				

# LOG OF TEST BORING

Waukegan Harbor Slip #3 Project ..... 65'SE & 23'NE of North

Location Corner of Slip #3

Boring No. B11

Surface Elevation 95.87

Job No. C 9729 1..... of ..... Sheet

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	S	AM	PL	Ξ		VISUAL CLASSIFICATION	so	IL P	ROP	ERT	IES
No.	Reco Type	e Woisture and Remarks						w	ιι	PL	D
1	SS	X _	W_	_ 7		* Loose, Black, Fine to Coarse SAND, Little Silt, Trace Fine to Coarse Gravel, Not Oily (SP)					
	SS	X	W	25	10-	Medium Dense, Gray, Fine to Coarse SAND, Little Silt, Trace Fine to Medium Gravel, Trace Organics, Not Oily, Lense of Black Organic Silt at					
3	SS	Х	W	13	15- - - - -	14.9-15.1' (SP)  Wash Water Turned Oily @ 16.0-18.0' Lenses of Coarse Sand & Fine Gravel @ 16.5-16.6', 19.4-19.6' &					
4	SS	X_	W	<u> 11</u>	20-	20.1-20.3', Not Oily					
5 6	SS	X	M	61 59	25	Borehole Backfilled with Bentonite					
					30-	End Boring at 26.4'  * Brown, Fine to Coarse Sandy GRAVEL, Some Silt (FILL) (GW-GM)					
					35 -						
WATER LEVEL OBSERVATIONS							<del> </del>	NER			
While Drilling							Sta 23/81 Complete 3/23/81 Crew Chief JR RigCME 550 Drilling Method 4" Casing to 22.5'; Rotary Wash Bore & Split Spoon				



#### LOG OF TEST BORING

OMC

Project Waukegan Harbor Slip #3
75'SE & 10'NE of North
Location Corner of Slip #3

Boring No. B12
Surface Elevation 95.73
Job No. C 9729

Sheet . . 1 .... of

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	S	AM	IPL	E		VISUAL CLASSIFICATION	so	IL PF	ROP	ERT	IES
		very	Mois		1	and Remarks	qu	w	ll	PL	D
No.	SS S	X	W	7	Depth	Brown, Fine to Coarse Gravelly SAND (FILL) (SW)  Loose, Black, Medium to Coarse GRAVEL, Some Silt, Little Sand (Crushed Stone Fill) Not Oily (GP-GM)					
					10-	Gray, Fine to Medium SAND, Little Silt (SP-SM)  Wash Water Turned Black, Assumed Organic SILT Lense, Not Oily (OL) Drove a Piece of Wood; Not					
3	SS	<u>х</u> х	W	<u>9</u> 5	<u> </u>	Oily But Chemical Odor (PT)  Very Loose, Gray, Fine to  Medium SAND, Trace Silt, Trace Organics, Lense Of Coarse Sand & Fine Gravelat 15.7-15.9 Not					
4	SS	X	W/M M			* Oily (SP-SM)  Very Stiff, Gray, Silty CLAY, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel, Very Oily (CL) Not Oily at Bottom of Boring					
					30-	Borehole Backfilled with Bentonite End Boring at 25.4'  * Wash Water Turned Oily at 20.0'					
Ur Tir	on C ne At	omp fter (	letion	of	40- FER	LEVEL OBSERVATIONS	Start	NER/ 3/24/8 Chiefing Mett 21.5';	l Comi JR R	3/ plete CME	24/81 550
ł	pth topth t						Bor	e & Sp	lit !	Spoon	

# ENGINEERING TEST RESULTS OF MUCK SAMPLES WAUKEGAN HARBOR SLIP #3 MARCH, 1981

	Muck Samala	В7	0.0	0.0	units
	Muck Sample	D/	B8	В9	<del>54.04.2</del>
	Wet Density (PCF)	68.79	66.84		the Mark/ft3 "as
	Dry Density (PCF)	29.13	26.88	48.69	Mathed & 2 Soldied
	% Moisture (drybas) at 105°C	136.11	148.64	41.53	Union Solis
	" Moisture (dry locis) at 20°C	134.25	146.64	40.89	the water × 15
	% solids at 105°9.	42,35	40.22	70,66	eros of much
	% Solids	42,69	40.54	70.98	they want you
dried	at 50°C)				

Example:

$$((136:11)(0.01) + 1)^{-1}(100) = 42.35$$
 percent rollde  
 $68.79(0.01)(42.35) = 29.13$  by density

GFP/cgj/dkp [WEI-7-2]



#### APPENDIX D

SOIL TEST RESULTS

DRAWING NOS. C 9729-A1, A2 and B1



